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# SOIL CULTURE, CEREALS AND FRUITS

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## EVIDENCE

OF

# DR. WILLIAM SAUNDERS

DIRECTOR, DOMINION EXPERIMENTAL FARMS

BEFORE THE

## SELECT STANDING COMMITTEE

ON

## AGRICULTURE AND COLONIZATION

## 1900

*PRINTED BY ORDER OF PARLIAMENT*

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# SOIL CULTURE, CEREALS AND FRUITS.

COMMITTEE ROOM 46,
HOUSE OF COMMONS,
Wednesday, March 21, 1900.

The Select Standing Committee on Agriculture and Colonization met here this morning at 10.30, Mr. McMillan, Chairman, presiding.

By request of the Committee, Professor Wm. Saunders, Director of the Dominion experimental farms, was present and gave the following evidence:—

MR. CHAIRMAN AND GENTLEMEN,—It affords me very much gratification to have the opportunity of again coming before you and reporting on some of the work which has been carried on during the past season at the experimental farms.

## BENEFITS OF THE PLOUGHING UNDER OF GREEN CLOVER.

Last year I submitted to you the results of some of the tests made with the ploughing under of clover, showing the beneficial effect to the subsequent crop by the ploughing under of green clover. In 1897 eight plots of one-tenth of an acre each were laid out at the Central Farm, four of which were sown with grain and seeded with clover in the proportion of ten pounds per acre, and the other four were sown with grain without clover. After these plots were harvested, the clover grew very vigorously, and by the end of October on those four plots which had been sown with clover, there was a heavy growth of clover to plow under. The other plots on which no clover was sown were treated similarly to those on which clover was used. The cultivation, soil and treatment were the same. The duplicate plots in each case were sown with the same kind of grain, so that the test was in every way a fair one. In 1898 the whole of these plots were sown with one variety of grain, Banner oats.

## INCREASE IN GRAIN AND STRAW.

I reported to you last year that the results of that sowing were such as to demonstrate in a very clear and marked way the great benefit of the ploughing under of clover, there was a great difference in the height of the grain and in its vigour of growth. One could see exactly the area that had been covered with clover by the stronger growth on these plots, and this unusual vigour was manifested right up to the time of harvest, when it was found that the average product of the plots so treated was eleven bushels and one pound per acre more than the average of those plots where no clover had been sown. This was an increase of 28 per cent in the grain. There was also an increase of 78 per cent in the weight of the straw. Experiments were conducted this year to try and find out whether the effects of the clover would last longer than one year. These plots were all ploughed towards the end of the season and after thorough cultivation in the spring, they were sown with Mensury barley. During the summer, when the crop was growing, it was still quite easy to discover the lines that had been occupied by the plots where clover had been growing, in the greater vigour of the barley, although it was not so manifest as it was in the first year when the oats were growing. The result was that while the increase



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in the grain in the oat plots had been 28 per cent, the increase in the barley in the second year was 29 per cent, and the gain in the straw was 35 per cent. This shows that the effect of the clover was very beneficial at least up to the end of the second year, and as far as its effect upon the grain was concerned it was fully equal to that of the first year. The straw, however, did not increase to the same extent. In the first year the yield of the four plots which had been sown with clover, gave in straw 78 per cent more than the four plots that had no clover, whereas this past year the increase of straw in the case of barley was only 35 per cent. The point I wish to emphasize is, that the effect of clover upon the grain the second year has been equal to what it was the first year. As the presence of a good supply of nitrogen in the soil tends to an increase in straw, we would expect this part of the crop would be relatively less the second year, but it was a surprise to find that the effect of the clover was so well maintained the second year in regard to the production of grain.

### COMPARATIVE TRIALS OF GREEN MANURES.

Another set of experiments was tried during the season with clover. In a field of four acres of oats, there were two acres which had barley the previous year sown with clover, 10 pounds of seed per acre, and the clover had been ploughed under. There was half an acre after pasture grasses where clover had not been used, and another half acre after pasture grasses with clover, and one acre after a crop of Brome grass. These were ploughed under and the field was sown last spring with one variety of oats which were sown on the same day. The results were as follows: The acre after Brome grass gave 33 bushels and 8 pounds; the half acre after pasture grass without clover gave 36 bushels 16 pounds; the half acre after pasture grass with clover gave 46 bushels 4 pounds, and the two acres after barley with clover ploughed under gave 43 bushels 25 pounds. These results show that where clover was ploughed under, either after barley or when grown with pasture grass, the difference averaged 10 bushels of oats per acre in favour of the land that had been treated with clover, on the whole area of four acres.

### GREEN CLOVER AS A MANURE FOR POTATOES.

In another field where potatoes had been planted and a portion of the space occupied by them had been sown with clover, and another portion alongside had not been sown with clover, the increased vigour of growth of the vines after clover of which there were six rows was quite remarkable, when compared with the six rows alongside which had been cropped without clover; the plants were much larger and healthier and retained their foliage longer. When the crop was dug there was found to be a difference of 28 per cent in the weight of potatoes in favour of the land where the clover had been used.

I do not think, gentlemen, there is any subject at the present time that is more important to the farmers of the Dominion than this one of the ploughing under of green clover to influence and increase the subsequent crops. As we all know, the farming community are a little difficult to move in such matters; but when once they feel sure of their ground they are quite ready to adopt any practice which will be to their advantage; the chief difficulty with all such subjects is to bring them under the notice of farmers. I think we cannot give too much prominence at the present time to this important subject, the ploughing under of clover. The cost of sowing clover with an acre of grain is so little that almost any farmer when once convinced of the benefit of the practice will resort to it. 10 lbs. to the acre is the quantity we have recommended, and this quantity has been found very satisfactory. The cost of the clover seed will not probably average more than 80 to 90 cents per acre, and as the seeding is done at the same time as the grain it is sown without extra cost.

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*By Mr. Rogers:*

Q. What was the nature of the soil on which you made these experiments?
A. The soil of the 8 plots to which I referred is a mixed sandy and clay loam, the sand predominating, and the four acres referred to in the other experiment had a dark sandy loam without any appreciable amount of clay.
Q. Have you tried it on clay?
A. Yes, we have tried the sowing of clover with grain on clay soil and it works very well. We had some 10 acres last year ploughed under of such land.
Q. The trouble is to get a good growth the first year in a clay soil?
A. We have not found any difficulty on the Experimental Farm, but none of our land would be regarded as very heavy clay.

*By Mr. Sproule:*

Q. When was this clover ploughed under? about what time of the year?
A. About the middle of October.
Q. The year it was seeded down?
A. Yes, the same year.
Q. In both cases?
A. Yes, in all cases.

*By Mr. Erb:*

Q. Was it pastured?
A. No, sir. It was not convenient to pasture this land, but we invariably recommend farmers to pasture such clover crops in the autumn if they can, because it is more profitable to do so.
Q. The pasture would pay for the seed?
A. I have met with a number of farmers during the past season who have adopted this plan and they have found the results to be very satisfactory. In my recent visit to Nova Scotia I met several farmers who have adopted this practice, and they are so thoroughly convinced of its value that they are going into it on a large scale.

PLOUGHING UNDER OF OTHER GREEN CROPS.

*By Mr. Featherston:*

Q. Have you made any experiments with the ploughing under of such crops as rye?
A. Yes, but we have made no comparative tests of it alongside of clover. I may say that all green crops ploughed under, improve the land for crop the year following, but rye does not improve it in so marked a way as clover does.
Q. I noticed a farmer ploughed rye 5 or 6 feet high into his orchard, and I observed that his orchard is improving all the time?
A. All green crops used for this purpose are of value when ploughed under, as they convert during their growth more or less food existing in the soil in unavailable forms into available plant food, and this is stored up in their substance and gives a large amount of food which can be easily appropriated by the next crop, which will add very much to its vigour and productiveness.

*By Mr. Cargill:*

Q. Did you succeed in getting a good crop of clover here?
A. Yes, sir.

*By Mr. Sproule:*

Q. You have sown clover with oats as well as barley and wheat.
A. Yes, with oats, barley and wheat.

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*By Mr. Rogers:*

Q. How much grain do you sow to the acre?

A. Usually 2 bushels of oats or barley and 1½ bushels of wheat; sometimes, when the oats are short and thick, 1¾ bushels is sufficient. We find that clover does very well with either barley, oats or wheat. Of course the oats if their growth is very strong are more likely to smother some of the clover plants, but we have not found any practical difficulty in this respect on the Central Farm.

*By Mr. Cargill:*

Q. How much clover did you say you used to the acre?

A. 10 lbs. of red clover.

*By Mr. Featherston:*

Q. You have never had a dry season here in Ottawa as we have in the west?

A. No, we seldom suffer from very dry weather.

*By Senator Perley:*

Q. How would white clover do?

A. The white clover would not give as good results; the growth is not so heavy and I think the seed is quite as expensive as the red. I believe the red clover would be much the more economical of the two. In previous experiments which we have tried with clover we have found that the roots penetrate very deep; within a year from the date of sowing we have found roots more than 4 feet below the surface.

*By Mr. Rogers:*

Q. Will it not root deeper if it is not pastured?

A. It is quite probable that the roots would strike deeper into the soil if the clover was allowed to reach its maximum growth without disturbance.

I would next call the attention of the committee to some of the results we have had during the past year with the use of special fertilizers on crops.

Q. Do the deep roots of the clover add to its value?

A. The clover roots which go down very deep into the soil, bring up from those depths quantities of plant food such as phosphoric acid and potash which are stored in the upper portions of the plants and when ploughed under are left within reach of such shallow-rooted crops as barley or wheat, so that clover may be regarded as an enricher of the soil in these elements also, since it brings them up from depths which other crops cannot reach.

*By Mr. Erb:*

Q. I have no reason to think but that clover will enrich the soil, but don't you think that if followed for a number of years the farmer's land will become more dirty with weeds?

A. No, I think not. We have found that after the grain harvest is over the growth of the clover is made so quickly that it smothers out a large part of the weeds that would otherwise grow, and we have found a smaller proportion of weeds in the clover plots than we have found in the soil where the land is sown with grain without clover.

There is another point to which I had not referred and which is a very important one, and that is the value of the clover as a catch crop during the latter part of the season, when it takes up all the fertilizing material that comes down in the rains a large part of which would otherwise be lost in the drainage waters.

Q. In our soil as a rule clover does not make such a heavy growth as to smother out the weeds, and if there are weeds such as the ragweed for instance, it would be likely to go to seed?

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A. In such case the farmer should cut such strong growing weeds and thus prevent them going to seed. I am not urging clover as a remedy for weeds. The question was asked if the land so treated would not get covered with weeds, and in our experience we have found such land to be less weedy than it would have been if allowed to stand without a crop after the grain harvest in the autumn. The average growth of clover with us has been from ten to twelve inches, and it usually grows strong enough to smother out most other weeds. It would not probably affect the ragweed materially, as that is so strongly rooted as to flourish under difficulties.

*By Mr. Featherston:*

Q. The idea of Mr. Erb, I think, is that if it was not seeded down you would cultivate the land after the harvest, and that would keep down the weeds.

A. In all these cases we must leave the intelligent farmer to use his best judgment. It would be better, if it was necessary to kill the weeds first, to defer the seeding of clover until the following year and cultivate the ground in the meantime.

*By Mr. Sproule:*

Q. Did you ever try sowing clover on land you intended to sow turnips in and allow it to remain until the following spring, and then plough it under as manure?

A. We have not tried that yet, but experiments have been planned along that line for next year.

EXPERIMENTS WITH BARN-YARD MANURE, ROTTED AND FRESH.

Last year I mentioned to the committee that we had carried on experiments with barn-yard manure, rotted and fresh, applying it to crops every year for ten and eleven years. It has been thought wise to change that experiment and endeavour now to get some information as to how long the effects of these ten applications of manure will last in the soil, and that is the point I wish to refer to next. The plots which have received the ten or eleven applications of barn-yard manure were left last year without manure; otherwise, they have been treated the same as the other plots. The wheat plots on which rotted manure has been used averaged for the eleven years 20 bushels and 56 pounds, while those to which fresh manure has been applied have given 20 bushels 52 pounds per acre. That does not, however, include the results of last year.

*By Mr. Featherston:*

Q. You are now comparing the rotted manure with the fresh?

A. Yes.

*By the Chairman:*

Q. What were the quantities used?

A. Twelve tons to the acre.

*By Mr. Perley:*

Q. How do you measure that?

A. We weighed it. The plots are one-tenth part of an acre, and we weighed and applied 2,400 pounds, which is the one-tenth part of 12 tons.

*By Mr. Erb:*

Q. Twelve tons each year?

A. Yes, for eleven years. In 1899 the manure was discontinued, and the crop was 23 bushels 40 pounds from rotted manure and 27 bushels 40 pounds from fresh manure.

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*By Mr. Featherston:*

Q. Was that fresh manure applied to the same plot each year?
A. The results I am giving you now are those of the first year after the manure has been discontinued.

*By Mr. Cargill:*

Q. That is with the same crops?
A. Yes, the same crops; so that while during the eleven years which rotted manure has been applied to one plot it has averaged 20 bushels 56 pounds; the same land this year without any additional manure gave 23 bushels 40 pounds, and the plot which had been treated for the same period with fresh manure gave an average of 20 bushels 52 pounds per acre, while this year, after the manure had been discontinued, the yield has been 27 bushels 40 pounds per acre.

*By Mr. Featherston:*

Q. They were about equal up to last year. I mean the plots that were treated with fresh and rotted manure?
A. Yes, there was only four pounds per acre difference in favour of the rotted manure up to last year.
Q. And this year the crop is altogether in favour of the fresh manure?
A. Yes, to the extent of four bushels per acre.

LOSS IN WEIGHT BY ROTTING MANURE.

*By Mr. Lang:*

Q. Was the manure weighed after rotting?
A. Yes.
Q. There would be a great deal more bulk of rotted than fresh?
A. I think the same bulk of rotted would be the heavier.
Q. It would be the bulkier?
A. I should expect it would pack closer. I have brought before the committee several times the subject of the loss in weight there is in rotting manure. You take 2,000 pounds of manure and rot it, and in less than three months you will have less than 1,000 pounds in weight. The point I have been trying to gain information on during these eleven or twelve years has been, what would be the relative value of equal weights of rotted and fresh manure when applied to the more important farm crops. That is the practical point in all these investigations, and to my mind it is a very important one.

*By Mr. Featherston:*

Q. You really lost one-half in the weight of the manure by rotting?
A. Yes, fully that.

*By Mr. Hurley:*

Q. That depends upon whether there is a great deal of straw there?
A. With the usual proportion of straw it loses fully one-half. There was an increase last year in the grain in nearly all the wheat plots and an increase also in the straw. While the straw from the rotted manure plot has given 3,544 pounds per acre as the average for the eleven years, last year it gave 3,860 pounds, and the straw from the fresh manure, which had given an average of 3,598 pounds during the previous eleven years, gave last year 4,550 pounds, the increase in the straw being larger where the fresh manure was used. That is a point in the experiments which has not been mentioned before.

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*By Mr. Featherston :*

Q. That is a good point too.

*By Mr. Erb :*

Q. In applying the rotted and fresh manure, you used the same quantities by weight in each case?

A. Yes, sir.

Q. Still, your experience has been that a certain quantity of fresh manure when rotted will lose half its weight?

A. That is correct. I wish to explain here that in rotting the manure for these experiments, the plan adopted has been that which is commonly followed by farmers, namely, composting it in the barnyard without any cover. We have found by careful chemical treatment—the Chemist at the Experimental Farm has reported on this—that you can rot the manure in absolutely tight vessels and with other proper conditions as to cover and moisture, without wasting any very large part of the fertilizing constituents. But these conditions are not practicable for the ordinary farmer, and it is better to present such results as are had from following the usual farm practice.

*By Mr. Featherston:*

Q. But you found the same difference in weights when the manure was rotted in that way?

A. Yes, and there is a loss of valuable constituents, but not nearly as much as there is when the manure is exposed and rotted on the ground in the ordinary way.

*By Mr. Erb:*

Q. Have you ever conducted experiments taking a certain weight of green manure and then taking the equivalent of that manure in the rotted form and see the difference?

A. We have not tried the experiment in that way. I do not think it would appear more conclusive than trying it the other way, that is taking equal weights of rotted and fresh manure as we have done in the experiments reported on.

Q. But I think you would show what a farmer would lose by allowing his manure to rot?

A. It seems to me that is shown as clearly the other way.

Q. The statement is made alongside of it that in rotting the manure it loses about one-half in weight?

A. Yes, that has usually been done.

*By Mr. Macdonald (Huron):*

Q. What is the reason of that decrease, the elimination of water?

A. A large part of the decrease in weight is due to loss of water. There is also a loss of the fertilizing constituents which can be determined by chemical analysis, and besides this there is a considerable loss in organic matter through the decomposition of the fibre, straw, and other solid materials in the manure, and during this decomposition carbonic acid gas is given off.

Q. There would not be very much weight in the carbonic acid gas?

A. Yes, this is a heavy gas, a compound of carbon and oxygen.

Q. Would that make the difference?

A. I think so. That process of decomposition, as far as it goes, is much the same in character as combustion, only less complete.

Q. Have you as much water in the rotted manure as in the green?

A. Usually about the same proportion.

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Q. It is really a very difficult thing to see how 100 pounds of green manure will lose 50 pounds by rotting.

A. The fermentation is a wasteful process.

Q. What does the weight that is lost consist of?

A. Chiefly water and carbonic acid gas.

Q. That will be one of the plant foods?

A. While this is not a plant food in the ordinary sense, it is absorbed by plants and converted into woody tissue. Plants take this in through the leaves.

Q. You regard 50 pounds of rotten manure as equivalent to 100 pounds of green manure?

A. No, it is not more than equal in crop producing power to 50 pounds of fresh manure.

*By the Chairman:*

Q. When fresh manure is put into the soil there is a fermentation goes on which liberates part of the fertilizing elements in that soil on account of that fermentation. This does not take place with the rotted manure.

A. I think that is almost certain. We know that the liberation of plant food is brought about largely by minute organisms which live in the soil and they propagate freely in fermenting manure, and I have no doubt that the fermentation which does take place when fresh manure is turned under is the chief reason why crops can be obtained from a given weight of fresh manure equal to those from the same weight of rotted manure. Further, in the process of rotting the elements of fertility that are in the liquid parts of the manure are largely lost, and these are more valuable pound for pound than the solids, hence the sooner you get the fresh manure into the ground the better, for the soil absorbs everything as the fermentation goes on.

The CHAIRMAN—Are there any other questions to be asked Prof. Saunders?

## OTHER EXPERIMENTS WITH FERTILIZERS.

Prof. SAUNDERS—I have a little more to bring before you in connection with this question of fertilizers. Last year I expressed the opinion that the artificial fertilizers used in connection with these fertilizer plots were not given a fair chance, for the reason that the humus in the soil was largely exhausted, and the announcement was made that it was proposed to sow clover in 1899 on all these plots and plow that in, mainly with a view to add humus to the soil and thus increasing its power of retaining moisture. In carrying this out there would also be the addition of the fertilizing materials collected by the clover crop, but as clover was to be sown on all the plots all would have an equal advantage. Clover was sown on all these plots. It took very well on most of the plots, except those which had received no fertilizers. There the clover was deficient in height, being only from four to six inches, while in the other plots it varied from ten to twelve or fourteen inches high.

*By Mr. Featherston:*

Q. That was ploughed in the fall?

A. Yes, about the middle of October; and that land is now waiting treatment in the spring, when it will be cut up with a disc harrow and harrowed with a smoothing harrow before sowing. We find the same difficulty as to lack of humus in the root crops and corn crops as we have found with the grain, and, as there is no practicable way of adding humus to these plots so as to have them comparable with what we are doing on the grain except by sowing clover, it has been decided to sow clover on these plots this year and let that clover go over until about the 23rd of May, by which time there will be a large increase of growth, when the clover crop will be still more valuable. For this reason the crops of corn and roots for 1900 will be discontinued on these plots.

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*By Mr. Rogers:*

Q. Is clover which has been killed out in the winter as valuable the next spring as when it is plowed in green in the fall?

A. I don't think it is, although it does not seem possible there can be any very great loss of fertilizing material from freezing. We have had clover crops injured in that way and have cut out square blocks four feet each way and about nine inches deep, and have examined every particle of that soil very carefully, taking out all the roots and tops, and we have found a considerable loss in the weight of the roots as well as of the tops where the killing out occurred; this led me to think that in all probability before we could plow in the spring there had been decay of the roots and a loss of the valuable fertilizing elements they contain through leaching in the soil, and I do not think the crop injured in that way would be equal in fertilizing power to a crop plowed in uninjured.

I have only given you the results we have had with wheat on the manured plots for the past year. I will now give you those had from the barley.

The average for the ten years in barley where the rotted manure has been used was thirty-four bushels, thirty-four and seven-tenth pounds to the acre. Last year when the manure was discontinued this plot gave thirty-four bushels, forty-three pounds, practically the same as the average for the past.

On plot two the fresh manure has given thirty-five bushels, twenty-one and one-tenth pounds as an average for the ten years. Last year this plot yielded thirty-three bushels, forty-six pounds per acre, which is a slight falling off from the average of the past. The weight of the straw also was a little less.

With regard to the tests with oats, ten years gave an average of forty-eight bushels, fourteen pounds from the rotted manure, while last year the yield was fifty-five bushels, thirty-three pounds per acre. The fresh manure has given fifty-four bushels, seventeen pounds as an average for the ten years, and last year we had fifty-five bushels and fifteen pounds, showing a decided increase, although no manure was used. There was, however, a decrease in the weight of the straw.

*By Mr. Featherston:*

Q. I notice in the comparison between spring wheat and barley the difference seems to be in favour of the rotted manure in case of the barley?

A. During the past year when no manure was applied, the barley did best after the rotted manure.

Q. How is that accounted for?

A. That is not easy to explain. The difference, however, is not large, it is a little less than one bushel per acre. In the case of the oats the difference is also a little in favour of the rotted manure, fifteen pounds only to the acre, but the results had from the wheat are decidedly in favour of the fresh manure, to the extent of four bushels per acre.

*By Mr. Sproule:*

Q. For ten consecutive years you applied manure to the same ground and took the average crop of these ten years?

A. Yes.

Q. Then you stopped one year, and after you stopped applying it you had a larger crop than when applying it?

A. In the case of the wheat a little larger, but I attribute that to a more favourable season.

Q. But had you a difference in barley?

A. In that case there was a falling off from the average of previous years.

Q Would not that seem to indicate that in the case of wheat you had better not manure at all?

A. That conclusion would be scarcely reasonable, the difference has probably been brought about by favourable weather for this crop.

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Q. You are going to continue that?

A. Yes, we want to see how long the results of the ten years manuring will influence subsequent crops, and we hope to continue these experiments until we gain some satisfactory information on this point.

As the result of this test for the whole period of twelve years in all, we have had an average crop from the wheat where rotted manure has been used of 21 bushels 10 pounds per acre, while with the fresh manure the yield has been 21 bushels 26 pounds. With barley, covering a period of eleven years, the plot treated with rotted manure has given 34 bushels 35 pounds per acre, while fresh manure has given 35 bushels 14 pounds.

With oats covering a period of eleven years with rotted manure, the average has been 49 bushels 3 pounds; with fresh manure, 54 bushels and 18 pounds.

In the case of the wheat in the twelve years' test, the difference has been 16 pounds per acre in favour of the fresh manure, 27 pounds in the case of the barley in the eleven years' test, and 5 bushels 15 pounds per acre in the oats in the test for eleven years.

The oat is a strong-rooted plant and penetrates deeper in the soil than the barley, and this, perhaps, is the reason for the difference in these two sorts of grain.

*By Mr. Sproule:*

Q. Do you think that experiment in manuring is one that could generally be followed by farmers? They generally manure their fields only once every five years.

A. Oh, no; we do not expect that farmers could follow us in that line, but in order to get information we have to make such experiments very complete, and it was thought that, by making an application of manure each year for a number of years, we should get very conclusive results.

*By Mr. Erb:*

Q. But it seems to me the experiments conducted in that line are not as convincing to the general public as if they were conducted along the lines of putting so much fresh manure and the equivalent of rotted manure and comparing the results. A farmer may have a hundred or two hundred tons of fresh manure. He either applies it fresh or rotted. If he allows it to rot, he cannot be expected to apply the same number of tons as when fresh. Consequently, he will have to manure less heavily to cover the same amount of ground.

A. There might be some advantage in that plan, but it seems to me quite clear if we apply twelve tons of the rotted manure to one field and twelve tons of fresh manure to another, and get equal or better results from the fresh material than we do from the rotted (and publish from time to time the loss of manure that takes place in the rotting process), that it is not difficult to understand.

*By Mr. Featherston:*

Q. Experiments have proven that the man who allows his manure to rot loses a great deal by doing so?

A. Yes.

*By Mr. Gould:*

Q. How in the case of manure that you could not put on the land without rotting on account of seeds? I know that I could not put on any manure from my farm, for I bought a very weedy farm.

A. Would you not apply your manure to a hoed crop?

Q. Even with a hoed crop, I would not put it on.

A. With ordinary weed seeds in the manure, if you apply it for a hoed crop, a few weeds more or less does not matter, as the same hoeing kills them all.

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Q. You take wild oats and wild tares, and if you get them in I am not going to say when you will get them out.

A. I may say that all our results are not expected to be followed strictly by any one. Every man must use his own judgment in all such matters, and if he knows what results we have had, he will be able to adapt our experience to his conditions.

Q. Take the farms in our country that are leased. Every lease contains a very strict clause providing that every bit of manure should be turned and fermented before it is put on the land. We could never keep our farms right unless we did so.

A. I know a good many practical farmers who are putting the manure on fresh, and they found it to be to their advantage to do so as far as this is practicable.

Q. I have no doubt that it is better for the soil and will produce larger crops, but the thing is for us to get our farms clean and keep them clean.

### EXHAUSTION OF SOIL BY CROPS.

*By Mr. McGregor:*

Q. With regard to growing of corn, oats, wheat or barley, have you any way of telling which is the hardest on the land.

A. Corn takes more of the fertilizing constituents from the soil than either wheat, barley or oats. In the case of corn you take off the land a very large crop. Supposing you get twenty tons per acre, cut green for ensilage, if you analyse that you will find that the sum total of the plant food contained in it is greater than that found in an ordinary crop of grain.

Q. Does not the corn take more from the elements for its nourishment?

A. It takes a considerable portion from the air, but it also takes much from the soil. There is an idea abroad that the corn is not an exhaustive crop and that it draws its nourishment chiefly from the air with the aid of sunshine. But this is not entirely correct.

*By Mr. Featherston:*

Q. It is all moonshine.

A. Yes, largely so.

*By Mr. Cargill:*

Q. How does the corn crop compare with the turnip in exhausting the soil?

A. I cannot give you from memory the exact proportion of the elements of fertility taken from the land by these two crops, but I shall be glad to give you these particulars another time.

*By Mr. Featherston:*

Q. Do you not think the potato one of the least exhaustive of crops.

A. I think it is. If you will permit me to defer answering these questions until to-morrow I will give you the exact figures.

### IMPORTANCE OF ADOPTING BEST METHODS OF SAVING AND USING MANURE.

I was going on to say that it is estimated that the manure in solids and liquids produced by farm animals in Canada is about 100,000,000 tons per annum, and each ton of this valuable fertilizer if properly saved may be safely placed at $1, which gives us a total value of 100 million dollars. If all this manure was carefully handled, preserving the liquids with the solids in tight troughs behind the animals, using sufficient straw as an absorbant and distributed over the land in a fresh condition, the saving effected would be very large as the value of this manure in bringing

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increased crops would probably be nearly double what it now is. This is a very large item in the economy of farm management in Canada which should be carefully considered by every practical farmer. It is a subject which is attracting at the present time the attention of the leading agriculturists in many parts of the United States as well as in this country. Last August I had the honour of bringing this subject prominently before the Society for the Promotion of Scientific Agriculture which met in Columbus, Ohio, at the meeting of the A.A.A.S. The results obtained from the experiments conducted at the Central Farm were presented on that occasion in a paper dealing with all the more important facts. A large number of the leading agriculturists of the United States were present. The number which took part in the subsequent discussion on this subject showed the keen interest awakened in the question.

During the past two weeks an animated discussion has been conducted by prominent writers in the New York *Tribune* and the *Commercial Gazette* of Cincinnatti; in each case the letters have called attention to the great value of the work carried on in this line at the Ottawa Experimental Farm and quotations have made from our reports in support of some of the arguments advanced. One of the writers remarked that 'the article in the Report of the Experimental Farms for 1894 is admirable.' That was the year when we called attention first to the great loss of weight in the rotting of barnyard manure.

Another prominent man writing personally to me says: 'Your station has given this very important subject careful study. I think you deserve high credit for the work you have done.' It is gratifying to see these leading authorities in the United States acknowledging so freely the usefulness and the thoroughness of the work done in Canada.

*By Mr. McGregor:*

Q. Taking all these results, I would say that farmers that can put their cattle into large loose boxes with floors that will not allow the liquid manure to escape can keep the manure in the best condition.

A. The tramping of manure by cattle is, I believe, attended with good results. We have not had many opportunities for experiment in that direction, but I am satisfied from the results which have been optained in Germany and elsewhere that manure loses much less of its valuable constituents when prepared by the tramping of cattle than in any other way.

Q. It absorbs the liquid, which makes it more valuable?

A. Yes.

*By Mr. Sproule:*

Q. You would want a cement floor so that it would retain the liquids, or a floor made impervious to soakage by being covered with clay?

*By the Chairman:*

Q. We have large box stalls with cement floors?

A. Such an arrangement is an excellent one. There are times when you cannot get the fresh manure on the land, and I believe there is no better way than this of preserving it.

*By Mr. Rogers:*

Q. Is it not better to have the straw cut when you want to have the manure fresh?

A. Yes.

Q. Long manure is very hard to work into the soil?

A. Yes, it is.

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EARLY, MEDIUM AND LATE SOWING OF GRAIN.

With your permission I will now refer to the subject of the early, medium and late sowing of garin.

We have been carrying on, as most of you know, for the last ten years experiments along this line. A piece of land has been set aside for the purpose, consisting of forty eight plots of one-tenth of an acre each. Eight of these have been sown as follows: two with barley, two with wheat, two with oats and two with pease, and these have been sown at the very earliest time seed could be put in the ground. Another series was sown at the end of a week, a third at the end of another week and so on for six sowings. These plots have all been harvested and threshed separately every year, and, as this work has now been continued for ten years with the grain and five with the pease, the average of the results may be taken as fairly reliable.

The results show as follows: with oats the second sowing has given the best results. Beyond this, delay in sowing involves losses in crop as follows: You will understand that the second sowing would be a week after it was just possible to get on the land to put the grain in. The first sown plots have always been at a disadvantage because the land was not quite fit; and another reason is that we are subject in Ottawa to wind storms at that period, which blow a good deal of sand about which injures the very early crop. A week of delay beyond the time named gives an average loss in the case of oats of 15 per cent, a delay of two weeks 22 per cent, three weeks, more than 32 per cent, and a delay of four weeks involves a loss of 48 per cent.

*By Mr. Cargill:*

Q. The second sowing would be an increase?

A. The second sowing has given the best results.

*By Mr. Featherston:*

Q. What is the comparison of the first and second week?

A. In the case of the oats the first sowing has given an average crop for ten years of 53 bushels 9 pounds, the second sowing 59 bushels 18 pounds. Barley, first sowing 38 bushels 21 pounds, second sowing, 44 bushels 9 pounds. Wheat, first sowing 17 bushels 59 pounds, second sowing 20 bushels 30 pounds; and pease, first sowing 30 bushels 26 pounds, second sowing, 33 bushels 57 pounds.

*By Mr. Cargill:*

Q. I understood you to say that the second sowing had given you an increase of 15 per cent over the first.

A. I fear you have misunderstood me. I was not giving the figures of difference between the results from the first and second sowing but the results of delaying a week beyond the second sowing. The second sowing is made a week after it is possible to get on the land, and the practice I am advocating is that as far as it is possible, all grain crops should be sown within ten days from the time when you can get on the land. In barley, a delay of one week beyond the second sowing causes a loss of 23 per cent, two weeks a loss of 27 per cent, a delay of three weeks a loss of 40 per cent, and a delay of four weeks a loss of 46 per cent. If the season opens early, it is not uncommon to find farmers sowing grain until a very late period. In spring wheat the loss is still greater, a delay of one week beyond the time named involves a loss of over 30 per cent, of two weeks a loss of 40 per cent, three weeks a loss of 50 per cent, and four weeks a loss of 56 per cent.

*By Mr. Rogers:*

Q. These experiments are only for the farm here?

A. These results have been had at the Central Farm in Ottawa and may be taken as a guide by the farmers of Ontario and Quebec. On the experimental farms in the

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west where so much depends on the conditions of moisture, the results are very contradictory. The crops had at the experimental farm for the maritime provinces follow ours very closely except that it does not seem quite so important to get the grain in very early there; but the sowing of grain in these provinces should be finished within fourteen days after the season opens, to give the best results.

*By Mr. Featherston:*

Q. You mean the season opens earlier there?

A. Yes; a little earlier, and the spring season is longer. Peas have been tested for five years, and the following results have been had. The second sowing has given the best results, beyond that, a delay of one week has resulted in a loss of 4 per cent, two weeks 12 per cent, three weeks 22 per cent, and a delay of four weeks has caused a loss of 30 per cent. The lesson taught by these experiments is that in Ontario and Quebec all cereal crops should be in the ground within ten days after the season opens. To accomplish this, the land intended for the spring crops should be ploughed the previous autumn, so that it may be got ready for seeding when spring opens with the least possible delay.

*By Mr. Rogers:*

Q. And if any crop must be late, peas will bear late sowing the best?

A. Yes; but still the loss is from 22 to 30 per cent if sowing is delayed for three or four weeks.

Q. But something must be the last?

A. Yes; that is necessarily so. Spring wheat should be sown first, for the reason that the loss from delay is greater there, and after that barley and oats. The loss, however, from delay in sowing these is pretty nearly the same in each case. Peas have less loss than any other of the four crops named from delay.

*By the Chairman:*

Q. There is another lesson to be taught from this, and that is the importance of having the land underdrained, so as to be able to get on it very early in the spring?

A. Yes, Mr. Chairman, that is a very important point, and one which cannot be too strongly urged, as the draining of land often enables a farmer to get in his crop from ten days to a fortnight earlier.

EARLY AND LATE SOWINGS OF ROOTS.

Along this same line, I brought before the committee two years ago the results we had from the sowing of root crops at different periods. We have now tried for five years two periods of sowing, one being two weeks later than the other. The date of the sowings has not been the same each year, for the reason that the seasons vary considerably. In 1895, when we began this experiment, the first sowing of turnips was made on May 11 and the second on June 12. Twelve varieties were sown, and the average gain from early sowing of these twelve varieties was 1 ton 642 pounds per acre that year.

In 1896 the season was a little earlier, and we began on May 8, when the first sowing was made, and the second on May 22. With fourteen varieties which were sown that year the results were in favour of early sowing by an average of 4 tons 1,424 pounds per acre.

In 1897 the earliest sowing was on May 8 and the second sowing on May 21. The gain on the plots early sown for the eighteen varieties tested that year was an average of 3 tons 1,870 pounds per acre over those later sown.

In 1898 the first sowing was on April 28 and the second on May 6, and the gain from early sowing on the nineteen varieties sown that year was 1 ton 488 pounds per acre.

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In 1899 the first sowing was on May 12, and the second sowing on May 26, and the gain of the earlier sowing of the twenty-five varieties tested that year averaged 4 tons, 704 pounds per acre in favour of early sowing. The average gain for the five years named with a number of varieties ranging from twelve to twenty-five has been 3 tons 226 pounds per acre in the case of turnips from the earlier sowings and the first of these sowings have been made between April 28 and May 12, depending upon the season.

With the mangels the results have been very much the same. While there has been a gain in the turnips from early sowing of 3 tons, 226 pounds on the average per acre, the mangels show a gain on the average of 3 tons, 1,251 pounds per acre, being the average of five years. The dates of the sowings were the same as I have given you for the turnips and the number of varieties have ranged from twelve to twenty. The results from early sowings of mangels by years have been as follows:—

| Date. | —— | Tons. | Pounds. |
|---|---|---|---|
| 1895 | Sown May 11; second sowing, May 25; gain from early sowing, average of twelve varieties | 4 | 126 |
| 1896 | First sowing, May 8; second sowing, May 22; gain from early sowing, average of thirteen varieties | 4 | 1,890 |
| 1897 | First sowing, May 8; second sowing, May 21; gain from early sowing, average of eighteen varieties | 3 | 452 |
| 1898 | First sowing, April 28; second, May 5; gain from early sowing, average of eighteen varieties | 1 | 1,273 |
| 1899 | First sowing, May 11; second sowing, May 25; gain from early sowing, average of twenty varieties | 3 | 714 |

With carrots the five years' test have given us a gain from earlier sowing of 2 tons, 972 pounds as an average for the whole time. The results for the several years with the carrots were as follows:—

| Date. | —— | Tons. | Pounds. |
|---|---|---|---|
| 1895 | First sowing, May 11; second sowing, May 25; gain from early sowing, average of twelve varieties | 4 | 164 |
| 1896 | First sowing, May 8; second sowing, May 22; gain from early sowing, average of fourteen varieties | 2 | 1,677 |
| 1897 | First sowing, May 8; second sowing, May 21; gain from early sowing, average of fifteen varieties | 1 | 1,443 |
| 1898 | First sowing, April 28; second, May 6; gain from early sowing, average of sixteen varieties | 1 | 563 |
| 1899 | First sowing, May 11; second, May 25; gain from early sowing, average of twenty varieties | 2 | 1,012 |

The gain from early sowing from the whole period has averaged 2 tons, 972 pounds.

*By Mr. Featherston:*

Q. Have you made any test as to the keeping qualities of turnips between the early and late sowings?

A. We have examined them as to texture and find the early sown a little more stringy than the others, but there does not appear to be any difference in feeding value, and the animals eat both quite readily.



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*By Mr. Sproule:*

Q. Don't you think that the early sowing has an advantage over the late sowing on account of the fact that with the early sowing the cold prevents the fly from appearing. We always sow early before the fly comes?

A. I think it would be an advantage where the fly is troublesome. We have not had much trouble on that account here.

*By Mr. Featherston:*

Q. The fly with us occurs from the 5th to the 15th of June?

A. Here again the farmer must adapt his practice to suit the conditions. The results we have had show a considerable gain from early sowing.

Sugar beets we have tried only three years. In 1897 there was a gain, taking the average of the results had at all the farms, of 1 ton 1813 pounds, and in 1899 a gain of 3 tons, 200 pounds in favour of the early sowing.

*By Mr. Sproule:*

Q. Have you the yield of the sugar beet there?

A. The yield per acre of the four varieties of sugar beets which have given the largest crop at all the experimental farms for the three years has been as follows: Danish Improved, 22 tons 28 pounds per acre; Red Top sugar 21 tons, 593 pounds; Wanzleben, 21 tons, 1,975 pounds (this is the variety grown chiefly in Germany for sugar), and Improved Imperial, 20 tons, 1,848 pounds per acre.

Q. Have you the yield of turnips as well?

A. Yes sir. The four years experiments with turnips gives the following six varieties as having done the best, taking all the experimental farms into account. Selected Purple Top, 32 tons 1,272 pounds; Perfection Swede, 31 tons, 526 pounds; Bangholm Selected, 30 tons 1,606 pounds; East Lothian, 29 tons 1,847 pounds; Hartley's Bronze, 29 tons 995 pounds; Jumbo, 29 tons 382 pounds, an average of 30 tons 1,104 pounds per acre.

Q. What was the size of the plots?

A. These calculations were made from two rows in the field, each 66 feet long. We commonly sow four rows of each variety, and take the two inside in each case.

*By Mr. Featherston:*

Q. Where do you measure from?

A. We take from the centre of the row in each case, these are all sown the same width, 2½ feet apart.

*By Mr. Sproule:*

Q. Do you think the same results would be obtained in a whole field as that high average? It seems to me you never obtain the same high average as you do in these experiments.

A. Usually the plots will give a larger yield. In my evidence last year, however, I quoted a number of instances in which the field crops were larger than the plots.

*By Mr. Erb:*

Q. Perhaps the farmers do not prepare the soil as well as you do?

A. I am sure they don't.

*By Mr. Sproule:*

Q. You give results of 32 tons, that would be 1,120 bushels to the acre, which is a very heavy yield for farmers' crops. We consider about 500 to 600 bushels a pretty good yield?

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A. Yes, that is an unusually heavy yield. I am unable to give you the results from recent field crops of turnips at the central farm. At the branch farm at Nappan last year we had from 900 to 1,000 bushels per acre.

*By Mr Rogers:*

Q. Sugar beets should pay well at $4.00 a ton at 20 tons to the acre?
A. They would pay very well at that price.

*By the Chairman:*

Q. What size were the beets?
A. These would be rather large for a sugar factory. We have grown them for feed.

### THE PRODUCTIVENESS OF VARIETIES.

Additional evidence has been obtained in the past year with reference to the productiveness of varieties. In 1899 we completed the five years' test of varieties of oats, wheat and barley. Forty-one varieties of oats have been under trial during the whole of that time, and the lists that we have published of the best twelve sorts in each case have been given for three years, four years and five years, and out of these forty-one varieties only fifteen have at any time found their way into the lists of the best twelve.

*By Mr. Featherstone:*

Q. There are only fifteen you recommend for growing?
A. I said only fifteen have found their way into the lists of the best varieties, nine of the same sorts have appeared each time amongst the best twelve, and eleven of these in the best twelve for 1898 appear also in the best twelve for 1899. That is, taking the average for the five farms. The only change in the list for the past year is the replacing of the White Russian by the American Triumph. White Russian has, however, given good results—66 bushels and 2 pounds per acre as an average for five years at all the experimental farms. Banner again heads the list this year.

The average yield of the different varieties for the whole period of five years has been as follows:—

| | Per Acre. Bush. | Lbs. |
|---|---|---|
| Banner | 75 | 30 |
| American Beauty | 74 | 31 |
| Columbus | 71 | 23 |
| Golden Giant | 71 | 12 |
| Bavarian | 71 | 9 |
| Golden Beauty | 70 | 2 |
| Holstein Prolific | 69 | 23 |
| Early Golden Prolific | 69 | 4 |
| American Triumph | 67 | 24 |
| Abundance | 67 | 24 |
| White Schonen | 67 | 24 |
| Wallis | 67 | 23 |

An average yield of 70 bushels and 13 pounds per acre for the twelve varieties for the full period of five years at all the different farms.



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RESULT OF TESTS OF VARIETIES OF SPRING WHEAT.

In spring wheat thirty-one varieties have been under trial for five years.

*By Mr. Featherstone:*

Q. Which of the oats is the best for heavy strong land? Which is the best for standing up?

A. I think it would be very hard to beat the Banner. That variety seems to adopt itself to many different sorts of soil.

Of the thirty-one varieties of spring wheat which were under trial for five years, sixteen only have appeared in the list of the best twelve. As in the case of oats, nine of the same varieties have appeared each time in the list among the best twelve, and those which have dropped out of the best twelve varieties this year continue to maintain their standing as very good yielding sorts, the lowest of them being less than a bushel per acre below the twelfth in the selected list. The list of the best twelve varieties of spring wheat, taking the average of the results obtained on all the experimental farms for five years, are:—

| | Per Acre. Bush. | Lbs. |
|---|---|---|
| Preston | 32 | 40 |
| Wellman's Fife | 32 | 12 |
| Monarch | 32 | 6 |
| Goose | 31 | 14 |
| White Fife | 31 | ... |
| Rio Grande | 30 | 53 |
| White Connell | 30 | 46 |
| Red Fife | 30 | 42 |
| Huron | 30 | 31 |
| White Russian | 30 | 28 |
| Pringle Champlain | 30 | 1 |
| Red Fern | 29 | 50 |

The average of the whole is 31 bushels and 7 pounds to the acre. With barley the results are still more striking. Of all the varieties of two-rowed barley tested, the same six varieties which were at the head in 1897 were at the head in 1899 and five out of the same six were at the head in 1898. In the case of the six-rowed barley the same six sorts appear in the list as the best six during the whole time. The six varieties of two-rowed barley which have given the best results for the five years were as follows:—

| | Per Acre. Bush. | Lbs. |
|---|---|---|
| French Chevalier | 44 | 40 |
| Danish " | 42 | 41 |
| Beaver | 42 | 39 |
| Canadian Thorpe | 42 | 26 |
| Sydney | 42 | 16 |
| Newton | 41 | 23 |

Giving an average for the six of 42 bushels 39 pounds per acre.

*By Mr. Semple:*

Q. Does the Mensury not yield well?

A. That is a six-rowed barley and these are the two-rowed. The best six varieties of six-rowed barley which have produced the largest crops for the past five years, taking the average of the results obtained at all the Experimental Farms, are:

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| | Per Acre. Bush. | Lbs. |
|---|---|---|
| Mensury | 50 | 15 |
| Trooper | 47 | 24 |
| Odessa | 47 | 24 |
| Oderbruch | 45 | 38 |
| Common six-rowed | 45 | 35 |
| Royal | 45 | 34 |

Making an average for the six varieties for five years of 47 bushels 4 pounds per acre, the Mensury leading in the yield in this list.

In peas reported on for two years, none of the same varieties appeared in the best twelve for the two years.

In the case of Indian corn, five of the same varieties are among the best six varieties for the two years.

In turnips five of the same sorts appear each year among the best six, and in mangels the same proportion is found.

In carrots the same six appear each year and exactly in the same order.

In potatoes where there are a very large number of varieties under trial and a greater tendency to vary in the field, the same tendency is manifest. Six varieties appear amongst the best twelve during the whole period. The six varieties which have appeared among the best twelve for the whole time are Late Puritan, Irish Daisy, Empire State, Clark's No. 1, American Wonder and State of Maine. Four others have appeared among the best twelve twice out of three times. These are Lee's Favourite, Carman No. 1, Seedling No. 230 and New Variety No. 1. In view of these new facts I have submitted to you and bearing in mind that in the arrangement of these plots each season, no efforts have been made to give to any variety any advantage in point of location, and since the land often varies in the same field, it seems quite remarkable, that the results covering so long a period as these tests have occupied, in different climates and in different soils, should have been so uniform in character. It is scarcely necessary to pursue this subject further. The facts given furnish the strongest proof of the inherent productiveness of varieties.

The good work we are doing in this country in the testing and introducing of productive sorts of grain, is attracting attention abroad and is bringing credit to Canada in the motherland. Prof. R. Patrick Wright, who is at the head of the West of Scotland Agricultural College at Glasgow, Scotland, wrote to me early in 1899, expressing his great interest in the work we were doing in testing varieties and asking that a selection be made from among those oats which had succeeded best here for trial in Scotland. Several varieties were sent to him and he has found, like ourselves, that the Banner stands at the head of all the varieties tried. In a letter received from him a few days ago, he says the Banner oat was tried on nine farms in different parts of Scotland against a number of other varieties, and he reports that the average yield given by the Banner oat was 4 bushels per acre more than any other sort tested. Prof. Wright, in speaking of the Banner oat, says :—

'The notable feature about the Banner, besides that it gave the highest produce on the average, was that it appeared to do well on all the kinds of soils in the experiments, and could be relied on to give a good crop on almost every farm.'

He asked for a further supply of seed, in order to enable him to continue these tests in Scotland, which he intends to undertake on a larger scale, and 12 bushels of Banner oats were lately sent to him for this purpose with 8 bushels of Golden Giant, a variety which has also given good satisfaction.

### CHANGE OF SEED GRAIN.

Another point which I wish to bring before you is with regard to some experience had during the past year, which seems to bear evidence to the benefit arising from change of seed. Last year a fresh supply was imported of three varieties of

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oats which had been grown at all the experimental farms for the past five years, to see what effect, if any, would be produced by a change of seed. The varieties were Improved Ligowo, California Prolific Black and Prolific Black Tartarian: The first two were imported five years ago from the same parties in France that we got the seeds from this year. The Tartarian was imported from England a year or so earlier. But these three varities were all imported from France in this instance. They were sown on all the Experimental Farms at the same time, side by side with seed that had been home grown for five years. The Improved Ligowo, from home grown seed, gave an average of 67 bushels 9 pounds to the acre, while the imported seed gave 72 bushels 16 pounds, a difference in favour of the imported seed of 5 bushels 7 pounds per acre.

*By Mr. Rogers:*

Q. Do you find that the black oat deteriorates quicker than the white oat?

A. I scarcely like to offer an opinion upon so complicated a question, and one so difficult to gain reliable information on.

*By Mr. Featherston:*

Q. You got a better return from the imported seed in this instance than from the home-grown seed?

A. Yes.

Q. Did you give it the same test?

A. Yes, and the home-grown seed was obtained from oats grown here from seed imported from the same source five years ago.

*By Mr. Rogers:*

Q. Do the black oats retain their colour?

A. The California prolific black retains its colour better than the black Tartarian. The imported black Tartarian gave 80 bushels to the acre, while the home-grown seed gave an average of 74 bushels 15 pounds per acre, a difference of five bushels 19 pounds per acre in favor of the imported seed. California prolific black gave 70 bushels 6 pounds per acre, while the imported seed gave 79 bushels 32 pounds, a gain of 9 bushels, 26 pounds per acre, the average gain of these three varieties from the imported seed was 6 bushels 29 pounds per acre.

*By Mr. Featherston:*

Q. It would be better then to import your seed every year?

A. I do not know that you would get the same every year. But these results seem to show that after growing the same variety for a number of years, some advantage is likely to arise from a change of seed.

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COMMITTEE ROOM 46,
HOUSE OF COMMONS,
THURSDAY, March 22, 1900.

The Select Standing Committee on Agriculture and Colonization met here this day at 11 o'clock a.m., Mr. McMillan, Chairman, presiding.

Dr. W. SAUNDERS, Director, Dominion Experimental Farms, was present at the request of the Committee and made the following statement:—

## PLANT FOOD TAKEN FROM THE SOIL BY DIFFERENT CROPS.

MR. CHAIRMAN AND GENTLEMEN,—Before presenting the subject I proposed to take up to-day, I wish to take the opportunity of replying to a question asked yesterday and upon which I promised to bring information this morning, as to the relative quantities of fertilizing materials which are taken from the soil by different crops. A wheat crop of 24 bushels of grain per acre with 2,200 lbs. of straw takes from the soil 40·53 lbs. of nitrogen, 17·64 lbs. of phosphoric acid, and 19·11 lbs. of potash.

Barley, with a crop of 35 bushels of grain and 2,000 lbs. of straw, takes 45·48 lbs. of nitrogen, 17·14 lbs. of phosphoric acid, and 28·25 lbs. of potash, as against 19·11 lbs. taken by wheat, showing that barley has a more exhaustive effect upon the soil in potash but takes up about the same as wheat with regard to nitrogen and phosphoric acid.

Oats, with a crop of 50 bushels of grain and 2,200 lbs. of straw, takes from the soil 46·3 lbs. of nitrogen, 15·22 lbs. of phosphoric acid, a little less than the barley or wheat, and 32·88 of potash, a little more than that taken from the soil by the barley and considerably more than that taken up by wheat.

Indian corn when cut for ensilage at 15 tons per acre will take from the soil 87 lbs. of nitrogen as against 40·53, 45·48 and 46·03 for wheat, barley and oats; the Indian corn crop also takes up 44·40 lbs. of phosphoric acid and 98·10 lbs. of potash. That is 98·10 for corn against 19·11 by the wheat crop, 28·25 by the barley and 32·88 by the oat crop.

I think similar information was also asked with regard to turnips,—taking a crop of 15 tons of roots only, and leaving the tops on the ground to be ploughed under, this takes from the soil 49·50 lbs. of nitrogen, 27·90 lbs. of phosphoric acid, and 82·25 lbs. of potash. Mangels take practically about the same of nitrogen and phosphoric acid and a larger proportion of potash. The quantities are nitrogen 45·45 lbs., phosphric acid 27·60 lbs., and potash 114·90 lbs. taken from the soil where 15 tons of mangels are produced per acre.

In the case of carrots with a similar crop of 15 tons per acre of roots only, 35·25 lbs. of nitrogen, 33·30 lbs. of phosphoric acid and 97·95 lbs. of potash.

Sugar beets are especially exhaustive of potash and take up 135·90 lbs. per acre where 15 tons of roots are grown, which is a larger proportion of potash than is required by any other crop I have named.

*By Mr. Wilson:*

Q. That is a different statement to what a gentleman made here the other day?

A. Yes, it is, but the analyses which have been made show that 15 tons of these roots grown on an acre take from the land 71·85 lbs. of nitrogen, 28·80 lbs. of phosphoric acid, and 135·90 lbs. of potash.

Potatoes take much smaller proportions of these elements from the soil. A crop of 200 bushels per acre of tubers takes 25·20 lbs. of nitrogen, 8·40 lbs. of phos-

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phoric acid and 34·80 lbs. of potash. With regard to the proportion of potash, however, the results of different analyses have varied. The figures I have given you are the average results of a number of analyses which have been compiled in a hand book published by the United States department of agriculture several years ago, but some European authorities claim that the proportion of potash is larger, and in one case it is given as high as 52 lbs. in place of 34. The difference in the soil where the potatoes are grown might make some difference in this respect, especially if the land is well supplied with this form of plant food.

*By Mr. McGregor:*

Q. How can you account that in common land I have seen 20 and 22 crops of corn running year after year and yet all were good crops. According to your estimate it would not be possible for the land to do this?

A. Much would depend on the original store of potash in the soil, which varies from five, seven or eight thousand pounds per acre, and the taking of say 100 lbs. per annum would require a long time to exhaust the store, especially if the land received a good dressing of barn-yard manure every four or five years, which would put back into the soil a large quantity of this element.

*By Mr. Hurley:*

Q. Was the corn on which this calculation is made grown broadcast or in hills?

A. I have taken in this estimate the production of ensilage corn 15 tons per acre cut at the glazing stage. This would be sown in rows or hills it does not matter which, corn sown broadcast produces such watery feed that it is of comparatively little value.

Q. Sowing corn broadcast is very hard on the land. You could hardly get the second crop without manuring it, whereas if you sow it in drills and hills you can get a good crop every year.

A. That is probably on account of the cultivation and stirring of the soil which allows the sun and air to act on the crop to its advantage.

### RESULTS FROM THE CROSS-FERTILIZING OF APPLES.

Another subject which I desire to bring before you is the results we have had this year from experiments begun five years ago in the crossing of apples, with the object of producing varieties hardy enough to stand the climate in Manitoba and the North-west Territories. The basis of this work rests on the extreme hardiness of a species of Siberian crab, a native of northern Russia, the seed of which was obtained from the Royal Botanic gardens at St. Petersburg the first year the experimental farms were started. The trees grown from this seed have proven entirely hardy at Brandon and Indian Head, where they have borne fruit quite freely. I have an example here of this hardy crab known as the Berried Crab *Pyrus baccata*. This fruit was crossed with several varieties of hardy apples including the Tetofsky, one of the hardy Russian varieties, and the Wealthy, both of which kinds are grown in nearly all the northern parts of Ontario and Quebec. Some interesting results have been obtained among these crosses, five of which have proven worthy of being named, and will be propagated for more extensive trial. Thinking these fruits would interest you, I have brought samples with me preserved in antiseptic fluids.

*An Hon. Member:*

Q. It is quite interesting.

A. Three of these are crosses between the Russian *Pyrus baccata* and the Tetofsky, and two of them between that and the Wealthy. I have a photograph here also which shows these fruits of the exact natural size, from which you will be able to judge of the advance which has been made in this instance by cross fertilizing.

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*By Mr. Douglas:*

Q. Have any of these been grown in Manitoba?

A. There are some of them growing there at the Brandon Experimental Farm, but they are not old enough to fruit yet.

The fact of the introduction of foreign blood into this wild species of Pyrus may make it a little less hardy than the original, but the fact that we have already tested, at Brandon and Indian Head, some of these varieties for one or two winters, points to the probability of their proving quite hardy.

### CROSS-BRED FRUITS—VARIETIES AND CHARACTERISTICS.

The work of cross-fertilization has been going on for five or six years, and there are now altogether nearly five hundred of these cross-bred fruits, each one a distinct variety. Last year 36 of these fruited, and out of these 36 five have shown points of special promise, and these will be propagated and tested in the northern parts of Algoma, in Ontario, throughout Manitoba and in different parts of the North-west Territories to the Rocky Mountains. These trees for trial will be placed in the hands of individuals who take a great interest in this subject, and we shall thus very soon find out how far they will be adapted to all the different climatic conditions which obtain in the districts referred to.

I will now call your attention to special characteristics of these several new varieties.

The variety Charles is a cross of the Tetofsky on the *Pyrus baccata* or Siberian crab. The tree is a very vigorous and upright grower, with large leathery leaves of considerable substance, and it branches quite close to the ground. The blossoms are deep pink in bud, a pinkish white when open, large, with wide petals. The fruit sets well on the tree, and when ripe the size was $1\frac{9}{16}$ inches broad and $1\frac{1}{16}$ inches deep. It is very distinctly ribbed, and the colour is a uniform yellow, very attractive, flesh yellow, solid, crisp, juicy, very mildly acid and very slightly astringent, flavour pleasant, skin rather thin, bakes well, makes very good apple sauce, and when compared with the Transcendent crab the size was practically the same, the acidity and astringency a little less. Stem long, calyx persistent.

The Novelty is a cross of the Wealthy on *Pyrus baccata*. The tree is fairly upright and a vigorous grower with good foliage. On this tree there were only a few bunches of bloom. These, however, set well. The fruit was ripe September 19; size one and a half inches across and one and a quarter inches deep, smooth, colour deep red, flesh a pale yellowish pink, firm, crisp and juicy, sub-acid and of fair quality. Stem long, calyx usually persistent, bakes well, quality very fair. This is the largest and best of the Wealthy crosses that have yet fruited.

The next one is the Aurora, a cross of the Tetofsky on the Siberian crab (*Pyrus baccata*). The tree is a vigorous grower upright in habit, leaves large, thick and leatherly. It blossoms freely and the fruit sets well, ripe September 11; size $1\frac{7}{16}$ inches across, $1\frac{3}{16}$ inches deep, colour bright red, almost all over, very pretty, flesh crisp, juicy, acid and of fair flavour, astringency very slight. When baked the fruit is acid but of good flavour. Stem long, calyx persistent.

The Progress is a cross of Wealthy on the *Pyrus baccata*. The tree is a vigorous grower and fairly upright in habit. It blossomed freely, and the fruit set well. The fruit was ripe September 14; size $1\frac{5}{16}$ inches across $1\frac{3}{16}$ deep. Colour deep red with some yellow and with a dark red cheek. Flesh very firm, crisp, sub-acid, juicy, astringency scarcely perceptible, of fair flavour. Stem long, calyx persistent.

Prairie Gem is a cross of Tetofsky on *Pyrus baccata*. This tree is a moderately vigorous grower and rather spreading in habit. It blossomed freely and was heavily laden with fruit from top to bottom. The fruit was ripe August 30. Size 1 inch across and 1 inch deep, colour brilliant yellow and crimson, flesh crisp, juicy, acid, flavour good, almost free from astringency excellent for jelly, deficient in size but promising for its earliness, its good quality and profuse bearing habit.

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*By Mr. Wilson:*

Q. Have you the apples here that you crossed with?

A. I did not bring them with me. They were the Wealthy and the Tetofsky. These varieties are so well known that I did not think it necessary to bring them.

Q. It would have been nice to have had them together to compare and see the improvement?

A. It would, I fear, however, that the only preserved specimens we had, have gone forward with the collection sent to Paris.

*By Mr. Rogers:*

Q. The Tetofsky I think is not an annual bearer, it bears only every two years?

A. On the Experimental Farm here it bears almost every year. It depends largely on the amount of the crop. It is a very heavy bearer at times, and if it bears heavily one year the crop is generally light the year following. All these varieties of cross-bred apples to which I have referred are remarkable for the persistent manner in which the fruit is attached to the tree. The stems are so firmly fastened that they require a considerable effort to detach them. The trees are all very strongly built with the branches bound to the trees with bands of woody fibre which are difficult to break. These peculiarities will be very advantageous where strong winds prevail. Root grafts were made of some of these varieties two years ago on account of their promising growth before we knew what the fruit would be like, and some of these, notably the Charles, which is perhaps the best of them all, wintered last year at Brandon and came through very well. A further supply was sent again last spring, also in advance of fruiting, both to Brandon and Indian Head, and now these varieties which have fruited will be sent for test in larger numbers. There is every reason from their parentage to expect that they will prove hardy, and there is no doubt if they do they will be highly appreciated. It is not anticipated that these new fruits will be much esteemed where larger apples can be grown, but if such fruits as these can be grown without special care or protection by farmers generally throughout the colder sections of our country, they will prove a great boon to the settlers in these districts and furnish a wholesome and healthful addition to the food of the people.

As the five varieties named have all been selected from the first 36 crosses which have fruited, it is probable that many other equal or possibly superior sorts to these here described may be found as the other cross-bred specimens come into fruit. Among those which are yet to fruit are crosses which have been made with a number of our best and hardiest sorts of apples.

The results I am now reporting are but the first steps in a series of experiments that are full of interest and promise to be of great importance and value to large areas in the Dominion. As the more promising of the cross-bred sorts bear fruit, seeds from the largest and finest specimens are being sown, from which we may expect many interesting sorts; and now that the continuity of nature has been broken by the work of cross fertilization, it is proposed to carry on the work of selection with seedlings of those crosses from which increase in size and improvement in the quality of the fruits will in all probability be gained, and within a few years we shall no doubt have a considerable number of useful sorts of apples, ripening at different periods, which will endure the climates of all the settled regions of the North-west country. Similar improvements were made by our forefathers with the original wild crabs, which were the only apples in early times, and there is no reason to doubt but that, by raising a large number of seedlings from the best examples of fruit, while some will sport back to the original, others will probably give us fruits of superior character.

*By Mr. Dugas:*

Q. Is this (referring to the photograph shown the committee) a different kind of apple or the same?

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A. The small apple in the centre is the seedling we started from the wild *Pyrus baccata*, and by the crossings referred to the fruits have been brought up to the size shown. They are useful fruits, valuable for jelly, and the large ones make good apple sauce and bake well.

*By Mr. Wilson:*

Q. This small one is very like the Hawthorn?
A. Yes, that is the original wild form of *Pyrus baccata*.

*By Mr. Hurley:*

Q. Was the Wealthy apple you crossed with the common variety?
A. Yes sir, it was the ordinary Wealthy.

*By Mr. Wilson:*

Q. What is the numbering on this photograph for?
A. The varieties are numbered on the plate merely for convenience for reference.
Q. Number "1" is not then the best there?
A. No. The numbering was not made from the standpoint of quality.

## TREE PLANTING ON THE NORTH-WEST PLAINS.

Much interest has of late been manifested in this country in the subject of forestry. This is a most important matter and one deserving the attention of every statesman. The necessity of husbanding our timber resources, protecting them against fire, and preserving a fair proportion of forest and wood land throughout the Dominion is of the utmost consequence to the welfare of the people. One important division of this subject relates to tree planting, and the need of trees for shelter and protection is strongly felt in the North-west country, particularly in the treeless districts. Persistent work has been carried on in this connection by the experimental farms ever since their organization, and one of the experimental farms, that at Indian Head, was purposely located on a bare prairie section of land, where at that time there was scarcely a tree or shrub anywhere within sight, so that a practical test might be made as to what could be done in successful tree planting there. Before giving you the particular results had on this prairie farm, let me present to you some details of the work done at the central farm in Ottawa to gain information in reference to tree growth. At the Central Experimental Farm, in 1888, tree growing experiments were begun and a block of land 165 feet wide, extending all across the west end of the farm was set aside for that purpose. A narrower strip 65 feet wide has been similarly planted along the northern boundary of the farm. This planting was continued year by year and completed in 1894. It was not found practicable to complete this planting in one or two years. About 3,000 trees were planted in 1888, 7,700 in 1889, and continued after that from year to year and completed in 1894. There are now growing in these forest plantations about 21,000 trees, including all the more important timber trees which are hardy in this climate. The objects in view in planting these forest belts at Ottawa were: first, to test by actual experiment the relative growth in circumference and height of a number of different sorts of trees when planted at different distances apart. The distances chosen for this trial were 5 feet by 5, 5 feet by 10, and 10 feet by 10.

Q. Were these trees planted in this way to stay?
A. They were planted in permanent plantations for experimental purposes. The distance of 5 feet by 5 apart is commonly recommended in most of the north-western States as the distance at which blocks of forest trees should be planted. Some were planted 10 feet by 10 and others 5 feet by 10, and thus we have had the opportunity of testing how the trees succeed under these different conditions. The

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second object in view was to gain information as to the relative growth of trees when planted all of one variety in a block, as compared with mixed clumps, and the third object was to gain information as to whether crops located near these tree belts would be favourably influenced by the shelter they afford.

Q. Will you come to the results of that ?

A. Yes, I can give you the result of the growth.

Q. No, the effect of shelter on the crops ?

A. We have not noticed effects in this respect in Ottawa, but I can give you instances of benefits resulting from shelter on the branch farm in the North-west.

Q. Could you give us that in your statement now ?

A. I shall with pleasure. Two or three years ago we sowed Banner oats at Indian Head on land in two different locations. In one case there was a shelter belt of trees 100 feet wide which at that time had reached a height of 20 feet; these were within a short distance of the oats. Another plot of the same variety was sown on the same day at a considerable distance from this belt. The plot that was sown distant from the belt was exposed to strong winds, which interfered much with successful growth, and the result was that the yield was 56 bushels from the exposed plot, as compared with 102 bushels from the plot which had the advantage of the shelter.

Q. Were the conditions in every other respect the same ?

A. The soil was of the same character and quality, and but for the fact that on the exposed plot some of the soil was blown from the roots, the conditions otherwise were apparently the same.

*By the Chairman :*

Q. Was the belt to the west ?

A. Yes, the belt was to the west. We have also had striking examples of the beneficial effects of tree shelter on that farm on root crops. In the North-west most of the crops depend largely on the proportion of moisture in the ground. The belts of trees collect banks of snow which extend quite a distance. The snow lies there until spring and when melting produces conditions of moisture much more favourable for the early starting of the seeds than where there are no shelter belts, and hence we have had instances where the crops of roots were much larger where sheltered by tree belts than they were on the more exposed parts of the farm.

The pleasing effects on the landscape produced by artistic grouping of the trees have not been overlooked; at the same time the main purpose has been to gain such practical information relating to the growth of the more important timber trees in this climate as would serve as a guide in future timber growing.

*By the Chairman :*

Q. You would not approve of planting belts of trees on the south or east side of the fields ?

A. No; in this country they seem to be more useful on the west or north side.

*By Mr. Wilson :*

Q. It is not that they would do damage if they were on those sides, but that they are more beneficial, is it not ?

A. Yes. The prevailing winds come from the north and west, and by breaking the force of these winds the crops are sometimes benefitted. The limbs of trees are marvellously built so as to offer obstacles to the continued course of the currents of air, and are very effective in breaking the force of such currents.

Q. All I want to know is whether you think it would be better without belts on the south and east than it would be if you had them ?

A. I don't think there would be any likelihood of injury from a belt on the south side, and it would certainly help your neighbour on the other side.

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Q. There is nothing like being neighbourly, you know?

A. It would no doubt please your neighbour.

Q. Would a belt on the south be likely to benefit the crop?

Q. I think the benefit to the crop would come chiefly from trees on the northern and westerly sides.

The CHAIRMAN.—My experience is that with a belt along the south side of the field you do not get the same crop for a distance from the belt as you do on the other parts of the field, while if you have it on the north side you will get a better crop.

A. In bringing this subject before the committee at this time, my object is to show what the experimental farms have been doing along this line of special work, and that by persistent effort, in distributing young trees and tree seed, we have done much to stimulate tree growing on the North-west plains.

*By Mr. Calvert:*

Q. How many years is it before you get the benefit of the trees?

A. I have specimens of the trunks of young trees here from Indian Head which will illustrate that. This is a specimen of the Russian poplar, nine years from propagation by cutting, that probably is the most rapid growing tree we have tested.

*By Mr. Wilson:*

Q. How large was this cutting when planted?

A. It was a small branch or twig probably about as thick as a lead pencil. Another, a specimen of the Dakota cotton wood, has been produced from a cutting in eight years.

Q. What do you mean by a cutting?

A. A cutting is an ordinary twig or branch, eight to ten inches long, which is buried in the soil up to the terminal bud. This sends out roots very soon, especially if the ground is moist, and the young tree makes rapid growth.

Q. Do you mean to say that it has produced this size from a cutting in nine years?

A. Yes, sir. That is a very rapid growing tree. These samples are from trees cut a foot from the surface, so as to have them uniform in diameter.

Another sample I have here is one of the Manitoba maple nine years from the sowing of the seed. The height of this tree will probably have been about twelve to fourteen feet.

Q. Will this be a fair average or is it one of the best specimens?

A. That is one of the best specimens. I cannot say how far it would be an average, but I think that the character of the growth would be very even except where the trees were crowded. When cut from a plantation which has been set out five feet apart, some will be found much larger than others, chiefly owing to less crowding and greater advantages in the way of light and air.

Q. Do these spring up from the roots like poplar?

A. No, they do not sucker. This specimen is interesting because we know its age from the seed, and it is to the growing of trees from seed that we expect the best and most useful results.

*By Mr. Calvert:*

Q. How many years growth from seed are these trees?

A. Nine years. In order to show you that all varieties of trees do not grow as rapidly as this one, I show you an American elm, eight years from transplanting as a seedling a year old. This tree is a very slow grown. I also have here a specimen of the green ash, a native of the country, this is also of slow growth, but is very tough and hard when grown. This shows the growth in eight years from the sowing of the seed.

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*By Mr. Wilson:*

Q. From that out would it grow much more rapidly?

A. I think that very likely it would.

Q. At the recent meeting of the Forestry Association it was said that trees grew faster at one period than at another?

A. That is no doubt correct, that at certain ages trees make more wood than they do earlier or later. The growth of trees is much like animals in that respect, there is a period of robust and vigorous youth and you finally get to the period of old age when——

Q. That is the time you grow the other way?

A. Yes, the growth is very slow.

*By Mr. Calvert:*

Q. According to that we would have no difficulty in keeping our forests up?

A. If properly cared for they would no doubt produce a large annual growth.

DISTRIBUTION OF FOREST TREES FROM THE CENTRAL FARM.

In 1888, 2,800 young forest trees of 28 different sorts were sent from the central farm to the branch farm at Nappan, Nova Scotia, where we have been doing some tree testing in order to gain experience in that climate. We also sent 20,000 the same year to the farm at Indian Head. In 1889 additional supplies of trees and shrubs were sent to Nappan; 12,000, comprising 118 varieties, were forwarded to Brandon, 15,000 to Indian Head and 7,000 to Agassiz. The latter consignment consisted chiefly of young trees of the most valuable hardwoods of the east. Experimental gardens in which forest trees were to be tested were laid out that year by the Canadian Pacific Railway at 25 different points along the main line between Moosejaw and Calgary. To each of these stations a bundle of well rooted young forest trees was sent from the central farm, each containing 175 trees of 37 different species.

During that season also 700 one-pound packages of seed of the Manitoba maple were sent to the settlers in different parts of the North-west Territory and Manitoba. Each of these packages containing seeds capable of growing from 500 to 700 trees.

*By Mr. Wilson:*

Q. Did you get any returns of the results.

A. Yes, many returns were made.

In 1890, 21,700 trees and shrubs were sent to the experimental farm at Brandon, 15,000 to Indian Head, and 8,000 to Agassiz. To farmers, chiefly those residing in the North-west, there were sent that season 131,600 young forest trees and shrubs in 1,316 packages of 100 each with instructions for their planting and care; 563 lbs. of tree seeds were also distributed. About 3,500 trees in packages of 150 each were also sent that season to the chief stations of the mounted police and to the Indian agencies in different parts of the North-west country.

In 1891 smaller supplies were sent to Nappan, Brandon and Indian Head, chiefly of sorts not hitherto tested and an additional quantity of 7,284 to Agassiz, B.C. 200,000 young forest trees were sent by mail to farmers in Manitoba and the North-west Territories in 200 packages, each containing 100 trees. During 1890 the trees in the North-west country bore an abundant crop of seeds and with the aid of Indians and half-breeds nearly 3 tons of tree seeds were collected in different parts of the North-west country from native trees growing in the coulées and in the ravines, as we have found that seeds grown in the country produce trees which succeed best there. The next season 4,053 one-pound packages of tree seeds chiefly box elder and green ash were sent out to as many different farmers in Manitoba and the Territories. In 1892 and each succeeding year many additional varieties of trees were

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sent for test to the Brandon and Indian Head farms and also to the other branch farms in order to prove those which are most hardy and useful in the different climates of the Dominion. A large number were also sent out that year to farmers in the North-west, not only from the central farm, but also from the Manitoba farm. Since 1894 this tree distribution has been carried on almost entirely by the branch farms at Brandon and Indian Head, settlers in Manitoba sending for such things to Brandon, while those in the North-west Territories have been supplied from Indian Head.

*By Mr. Rogers:*

Q. Is that maple considered a success up there?

A. Yes, I think it is the most successful tree we have grown there.

*By Mr. Erb:*

Q. Is this propagated from the seed only?

A. It does not sucker, and we have never tried to grow it from cuttings. It is so easily raised from seed that we have raised large quantities of seedlings and send them out when they are one year old. In the west we must I think depend on the distribution of tree seeds for the extension of this good work. That course has given us thus far the best results.

Q. Is this tree liable to send out shoots from the base of the trunk like our soft maple?

A. Yes, it has much the same habit, but with a little trimming this can be overcome when the tree continues to grow with a nice clean trunk, that is after six or eight years' growth.

Q. Is it not one of the peculiarities of this tree that its trunk grows crooked?

A. Yes, the trunk does very often grow more or less crooked.

Q. I have seen them in nurseries in our part of the country and there was hardly one with a straight stem.

A. With a little care in trimming when young most of them can be grown fairly straight. There are avenues of these trees growing on the Experimental Farm at Brandon which are as straight a lot of trees as you want to see, but it has the tendency to grow crooked and sometimes in individual specimens it is difficult to control. It is better when planting an avenue or grove to reject those that are crooked and select the best. The Norway maple has the same habit, and this is regarded as a valuable tree in Europe and in Ontario and the East. The tree planting and distribution at Ottawa during the past 12 years has aggregated as follows:—

At the Central Experimental Farm there has been planted including forest belts, avenues, ornamental planting, hedges and arboretum, over 40,000 trees. The distribution to the branch farms has been as follows: To Nappan about 4,000, Brandon 65,000, Indian Head 70,000 and Agassiz 35,000.

The distribution from Ottawa throughout the Dominion, which has been chiefly to settlers on the North-west plains, has amounted in all to about 560,000 young forest trees, sent out in bundles of 100 each, and about 9,000 lbs. (4½ tons) of tree seeds.

At Nappan, Nova Scotia, from the forest trees and shrubs sent there much useful information has been gathered in reference to the hardiness and suitability of the different species to that climate. Small permanent plantations have been made and a limited number of trees distributed among the farmers of the maritime provinces for trial.

### TREE GROWING IN MANITOBA.

At Brandon, Manitoba, a large proportion of the 65,000 trees and shrubs sent from the central farm have been for trial planting on that farm. While many of the varieties have proved too tender for that climate and a large number of trees have died, a very large number have been successfully grown. Many thousand

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young trees have also been raised from seed on this farm and set out in the plantations. The number of trees and shrubs now growing at Brandon, in wind-breaks, avenues, hedges and the arboretum, is from 70,000 to 80,000. The work done on this branch farm has greatly stimulated tree growing in Manitoba, and the public have availed themselves freely of the information and practical object lessons given there.

From this farm there has been distributed among the farmers of Manitoba, of young tree cuttings and tree seeds in all up to the present time, about 600,000 and about 1,800 lbs. of tree seeds.

### TREE GROWING IN THE NORTH-WEST TERRITORIES.

At Indian Head, North-west Territories, the branch farm has also done much to promote tree growing on the plains. To such trees sent there from the central farm as have proven hardy, there has been added a large number of native trees raised from seed collected in the Territories, and the total number now growing on that farm is about 125,000.

There has also been sent out from Indian Head to farmers in the Territories, in packages of 100 each, about 220,000 young forest trees and cuttings, and about 4,000 lbs. (two tons) of tree seeds.

### TREE GROWING IN BRITISH COLUMBIA.

At Agassiz, British Columbia, the greater part of the 35,000 young trees received, about two-thirds of which have been of hard woods from the East, have been used for planting on the farm, mostly on the sides of the mountains, with the object of finding out whether these trees, so valuable for their timber, can be successfully grown in that climate. A limited distribution has also been made to parties specially interested in tree growing in British Columbia.

The figures I have given you show that during the comparatively brief period of 12 years since the experimental farms were founded, the trees planted on the five experimental farms number in all about 245,000, and during the same time there has been sent out to individual lovers of trees, in lots of 100 each, more than one and a quarter millions of young forest trees and cuttings, and about 15,000 lbs. (7½ tons) of tree seeds, every pound of which, with ordinary care, will produce from 700 to 800 young trees.

*By Mr. Wilson:*

Q. Was any charge made for these?
A. No, they are all sent free.

*By Mr. Calvert:*

Q. Where do you get these trees?
A. We have grown them at the experimental farms at Brandon and Indian Head, chiefly from seeds of the Manitoba maple and ash collected in the North-west. Besides these the seeds of many shrubs have been distributed. The Caragana is one of these, a tall growing shrub valuable for hedges or for growing singly on the lawn. Some other useful sorts have also been distributed.

*By Mr. Semple:*

Q. Have you experimented with fir trees in the West?
A. Yes, we imported in 1888 from one of the Russian government forests, North of Riga, seeds of the hardiest form of useful pine we could get, a variety of the Scotch pine, and raised about 50,000 or more of young seedlings and distributed them. We have a few of them growing on the branch farms quite successfully now, but they

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have not been a success generally. It seems to be a very difficult matter to grow any other evergreen than the white spruce in the North-west. That is native in some parts of the country and can be transplanted without much difficulty. We have not found any of the European evergreens entirely hardy there in the open, but, when shelter is provided by the growth of native trees, the Scotch pine and Norway spruce will sometimes succeed. The Manitoba maple or box-elder is now very generally distributed. There is scarcely a farmer in the West who has not his little plot of trees, some five or six years old, some younger. These plantations furnish more or less shelter for the buildings and stock and for the growing of garden vegetables, small fruits and flowers, and at the same time make the dwellings of the settlers more attractive and homelike. Since experience has shown that the box-elder, the tree most used in this distribution, grows rapidly and begins to produce seed when about six or seven years old, a very large number of the seeds distributed during the earlier years must have reached seed bearing age and the quantity of seed convenient and available will now be greatly increased from year to year, and thus an immense impetus given to tree growing on the western plains. On the experimental farms at Brandon and Indian Head large supplies of seed are now ripened every year, sufficient to provide for an extensive distribution every season.

Tree planting is a very important question for the North-west country, and I believe that every effort should be made to assist settlers in their efforts to provide shelter for their homes and to make them more attractive.

*By Mr. Wilson :*

Q. You have done well to bring up this important matter. I am sorry none of the representatives from the North-west are present.

COST PER ACRE OF GROWING FOREST TREES.

*By Mr. Erb :*

Q. Before leaving the tree question, have you any figures to show the cost per acre up to the present of the tree planting on any of the farms ?

A. We have kept an account of the cost of planting per acre and of cultivating until the trees were large enough to shade the ground so as to prevent weeds from growing, and hence need no further care at the branch farm at Brandon, Man., where it has cost $16.25, also at Indian Head, N.W.T., where it has cost from $12 to $18 per acre, varying with the kind of trees used and the distance at which they were planted.

*By Mr. Wilson :*

Q. Do you bestow any labour on the trees after planting them ?

A. We use a horse cultivator between the rows—that is generally done twice each season—and have also to do a little hoeing. As a rule, by the time the trees are four or five years planted they shade the ground so completely as to require no further care.

METHODS OF PLANTING.

*By Mr. Calvert .*

Q. Did I understand that you planted the trees five feet apart ?

A. Yes, usually five feet apart each way.

Q. How many rows do you usually put in your shelter belts ?

A. At Indian Head it is 20 rows, that is 100 feet in width ; this runs all along the north and west borders. On the east we have a hedge where the trees are growing close together. This has been produced by sowing a single row of tree seed and the seedlings are allowed to grow thickly. In this way a hedge is soon formed



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without much labour. On the south boundary there is an avenue planted of trees 20 feet apart.

Q. Do you think that necessary for every farm, a belt 100 feet wide ?

A. Not necessarily so. In the North-west, however, where the winds are very strong, it requires a wide belt to break their force. Possibly a narrow belt might serve the purpose.

Q. You have not planted them any less ?

A. We have on the central farm here, where the belts are 65 feet in width on the north boundary and 165 feet in width on the west boundary. At Brandon and Indian Head we have used thick hedges as wind-breaks, made by planting two and three rows of trees three feet apart, the trees being put about two feet apart in the rows, and these have soon formed excellent shelter.

*By Mr. Erb :*

Q. On the central farm what variety of maple do you find most suitable ?

A. The sugar maple is perhaps the best, but the white or silver grows the most rapidly. The silver maple is a soft maple, a native of Ontario, and is found as far west as Minnesota. The leaves are silvery underneath.

Q. Does it ripen its seed here ?

A. Yes, and also when grown further north. The furthest point north that I know of where these trees are growing is near the old station at Portage la Prairie, Manitoba. These are 8 or 10 trees in a group there old enough now to bear seed, and I have made arrangements when they bear seed to have it collected. If we can get seed from so far north they will probably produce seedlings hardy enough to stand the climate in most parts of Manitoba. There are several of these trees growing at Winnipeg also.

*By Mr. Wilson :*

Q. Don't you find the ordinary soft maple about as good as any in this section ?

A. Yes, but it does not do as uniformly well as the sugar maple.

Q. It grows more rapidly ?

A. It does grow more rapidly at first, but after a time the sugar maple will usually overtake it and eventually make a larger and better tree in this climate. You will see along the streets in Ottawa that the sugar maple is healthier than the red maple.

Q. And it is a finer looking tree, too ?

A. Yes, I think it is.

*By Mr. Rogers :*

Q. To what height does the box-elder grow in Manitoba ?

A. There are old trees growing along the river valleys and elsewhere that will sometimes measure two feet or more in diameter. The largest planted tree I know of is one at Silver Heights, a farm owned by Lord Strathcona. There are Manitoba maples growing there that will measure about 18 inches through, and range from about 30 to 35 feet high.

## DISTRIBUTION OF SAMPLES OF SEED GRAIN.

The usual annual distribution of trial samples of cereals and potatoes is now in progress. The interest in this work is unabated and although the samples are now sent only on individual application the demand is as brisk as ever. This is indicated by the correspondence we receive. During the month of February the number of letters received by the Director was 13,054 and in March up to and including yesterday, the 21st, there were received 14,746 letters, making a total of 27,800 letters in 49 days, being an average of 662 per day for the whole period.

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*By Mr. Wilson:*

Q. How many secretaries have you to answer them?

A. We have no increase in the staff for this purpose, we have two looking after the French letters, and two working at the English letters. We try to send, as far as possible, to each individual some sort of answer. A large proportion of the letters I referred to are answered by promptly sending the samples requested. These have been going out for some time at the rate of 400 to 450 per day. If samples cannot be mailed promptly, we send as far as practicable an acknowledgment. There are always, however, baskets full of letters which require special answers sufficient to keep the officers all busy.

*By Mr. Calvert:*

Q. Where do they come from? largely the West?

A. From all over the Dominion.

*By Mr. Wilson:*

Q. You occasionally get postcards that seem to be similar in dictation?

A. We do get some.

Q. I have heard of members getting them ready and sending them out for people to put their names to.

A. They come in sometimes very similar in composition; occasionally ingenious devices are resorted to for correspondents to assure larger quantities for individual use than our regulations allow. For instance, we will sometimes get ten or twelve letters all in the same handwriting asking for samples for James and Tom and Mary and Mrs. and Mr. so and so, and half a dozen other names of children, all asking for some particular variety of grain evidently for the purpose of getting a large quantity for one farmer. All such are referred to me and I endeavour to deal as justly as I can in such cases. The number of the three-pound samples which have been sent out by mail this season up to the present time is 10,730. These have been sent to the different provinces as follows: Ontario, 2,778, Quebec, 2,714, Nova Scotia, 1,402, New Brunswick, 1,292, Prince-Edward Island, 454, Manitoba, 1,318, North-west Territories, 648, and British Columbia, 124. I suppose we must have from 15,000 to 20,000 applications still on hand to fill before the season is over.

A new feature was introduced in connection with the distribution of seed grain last year, that was the sending to a few of the best farmers in every constituency in the Dominion a larger sample, sufficient to sow one-tenth of an acre, and this has worked very well. A great deal of interest has been taken in it.

*By Mr. Wilson:*

Q. How did you find out the farmers to send to?

A. The plan adopted was this, we took the returns which had been made on the 3 pound samples by farmers the previous year, went over some seven or eight thousand of them, and selected from these a limited number in each constituency of what we believed to be the best farmers, taking those which by their reports showed most interest in this work.

Q. The reason I asked was that I have not heard anything from my constituency of anything of that kind.

A. I have the names in the book which I have with me, and can give those in any constituency if desired.

Q. That is all right, never mind now.

A. A similar distribution has been authorized by the minister this year and is now in progress. Up to this time 1,351 of these special samples have been sent to applicants. The plan adopted this year is to send again to those who made prompt reports of the test of the variety, if they so desire, allowing them to select the sort they prefer to test, and adding to the list from time to time the names of any good

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farmers suggested, provided we do not get too many from one constituency, the object being to distribute these special samples as evenly as possible over the whole Dominion. It has not been possible to prepare for publication the results we have received, but it is hoped that this work may be overtaken before long.

I have with me some particulars of a few of the best results which have been reported by farmers in different sections which may be of interest. In Banner oats, Mr. James A. Hagen, of Sowerby, Algoma, reports that he raised from the Banner oats sent him a crop equal to 110 bushels to the acre. Mr. Alexander Mackenzie, of Campbellville, Halton Co., raised at the rate of 92 bushels and 22 pounds. Mr. George White, of Echo River, Algoma, reports 106 bushels 26 pounds per acre of the Improved Ligowo oat. In West Bruce Mr. M. L. Martin, of Glammis, reports 102 bushels 22 pounds per acre of the same variety.

*By Mr. Rogers:*

Q. What variety was that?

A. The Improved Ligowo. We have other reports regarding that variety. Mr. W. H. Pritchard, of Ripley, reports 77 bushels 32 pounds; Mr. Edward Prout, of Bowmanville, both East Durham, 104 bushels 14 pounds; Mr. Harry L. Wood, of St. Thomas, Elgin County, 120 bushels; in Huron West, Mr. Walter Hick reports a yield of 91 bushels 6 pounds, and Mr. George Scott, Wanbuno, Lambton County, 86 bushels 26 pounds per acre.

*By Mr. Calvert:*

Q. What quantity of seed did they have?

A. The quantity of oats was 8 pounds, sent in 2 bags of 4 pounds each; of barley and spring wheat, 10 pounds—2 bags of 5 pounds each. The number of varieties was limited to fourteen, six of oats, four of spring wheat and four of barley.

In Golden Giant, A. Addley, of Perth Road, Addington, reports a yield of 71 bushels 6 pounds per acre. In East Hastings, H. Bowen, of Deseronto, had 90 bushels, and in North Hastings, George Ryan, of Bird's Creek, had 95 bushels. In Bavarian oats, Thomas Duston, of Belmore, in East Bruce, reports 108 bushels 28 pounds. Of American Beauty, in Frontenac, Mr. W. H. Woodman, of St. Lawrence, had 96 bushels 16 pounds, and in the North Riding of Grey, James Lemon, of Walker's Falls, reports 79 bushels 14 pounds. William Ritchie, of East Riding of Bruce, reports 79 bushels 4 pounds. These are some of the best reports we have received, showing you how the varieties turn out when they get into good hands.

*By Mr. Rogers:*

Q. I know the Mr. Woodman you mentioned and he told me about that. He was very much pleased and will do what he can to distribute that seed in his section of the country as soon as he has sufficient; he is very much taken with it.

A. As showing how the work of the experimental farms is appreciated, I would like permission to read a letter as a sample which I got a few days ago from Carman, Manitoba, from Mr. William A. Finch. Many of such letters are received every year. He says:—

"CARMAN, MANITOBA, March 8, 1900.

"DEAR SIR,—I often think we farmers neglect a duty in not giving some of our experience in return for the valuable information furnished us by your reports and bulletins from time to time; for myself I can say they have been a great help to me financially, and this I consider is the chief lesson to learn.

"In hog feeding last season I bred three young sows, raised 24 pigs, average 150 lbs. in seven months, Yorkshire cross with Berk, made 185 lbs., fed barley chop and wheat cleanings with skimmed milk; these hogs with sows netted me $280.00.

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"My potato crop will bring me something over $120, and I also raised 40 bushels of onions which netted me $42, carrots $5, milk 12 to 15 cows, sold 1200 lbs. of butter, average price 17½ cents, hen fruit some $40, besides a family of eight supplied, also 1,850 bushels of wheat, 560 of barley, 1,700 bushels of oats, from the seed which I obtained from the Experimental Farm (Banner oats). We work two teams, five horses altogether, hire one man at the harvest.

"I am one who thoroughly believes in mixed farming, a conclusion I came to some years ago in reading your literature which your department has kept me supplied with. Please accept my thanks for same and I trust the department will find more who will appreciate the work you and your staff have undertaken."

Hundreds of such letters could be produced if required, showing that the good seed sown is bringing forth fruit on all hands. With regard to the rapidity with which grain increases, I received a report a few days ago from Mr. O. Belanger, Chelmsford, Algoma, who received a three-pound sample of Banner oats four years ago, and this season he has threshed over 3,000 bushels, most of which he has for sale. That seems a large quantity, but it might have been much larger. Supposing the three-pound sample to have produced two bushels the first year, which is a low estimate, and 50 bushels per acre from subsequent sowings, sowing 2 bushels of seed per acre, the crop of the second year would be 50 bushels, which would sow 25 acres; continuing at the same rate the third year's crop would be 1,250 bushels, and the fourth year 31,250 bushels.

Q. What is the average weight per bushel of the Banner oat?

Q. It does not go much above the standard of 34. Ours this year ran about 37.

Q. Of course, the reports given are always by weight?

A. Yes, always by weight. The work on all the branch farms has progressed satisfactorily during the past year, and the crops have been good. Further experiments have been conducted at Nappan with the herd of milch cows, and experiments in the fattening of steers have been conducted at nearly all the farms, also experiments in the fattening of swine.

The uniform trial plots of all the more important farm crops have been continued and the results of these have been published in Bulletin 34. A large number of other useful experiments have also been conducted. The season at Agassiz, while fairly favourable for the growth of cereals and roots, has not been favourable for fruits. The very wet weather which prevailed in the spring extended all through the blossoming period and prevented the fruit from setting, and the crop has been very light. The trees, however, have made a thrifty growth and at present are full of promise for the coming year. At all the experimental farms much time and attention has been given during the past season to growing a great variety of products for the display now being set in order at Paris. These include a large number of varieties of cereals, fodder crops and grasses, also fruits and some vegetables. The material which has gone forward from the farms will form a very considerable and important contribution to the Canadian display.

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Having read over the foregoing transcripts of my evidence of the 21st and 22nd March, 1900, I find them correct.

WM. SAUNDERS.

*Director of the Dominion Experimental Farms.*

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